(12) UK Patent Application (19) GB (11) 2 344 132 (13) A

(43) Date of A Publication 31.05.2000

(21) Application No 9919798.0

(22) Date of Filing 23.08.1999

(30) Priority Data
(31) 9825798 (32) 25.11.1998 (33) GB

(51) INT CL[7]
E03B 3/02

(52) UK CL (Edition R)
E1X XK1

(56) Documents Cited
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GB 2220223 A GB 0293224 A

(58) Field of Search
UK CL (Edition Q) E1X XK1 XK7B
INT CL[6] E03B 3/02

(71) Applicant(s)
Brian Leslie Nicholas
64 Trent Vale, Walney Island, BARROW IN FURNESS, Cumbria, LA14 3BN, United Kingdom

(72) Inventor(s)
Brian Leslie Nicholas

(74) Agent and/or Address for Service
Ian Palmer
3 Abbotsfield Gardens, BARROW-IN-FURNESS, Cumbria, LA13 9JX, United Kingdom

(54) Abstract Title
Rainwater collection and supply

(57) Apparatus for the collection and supply of rainwater falling onto a building comprises collecting means (3) located on the roof, storage means (4) located in the eaves of the attic space and means to supply the water for non-hygienic 'grey' applications, using only gravity to move the water. A mains back-up system is provided for use in periods of prolonged drought.

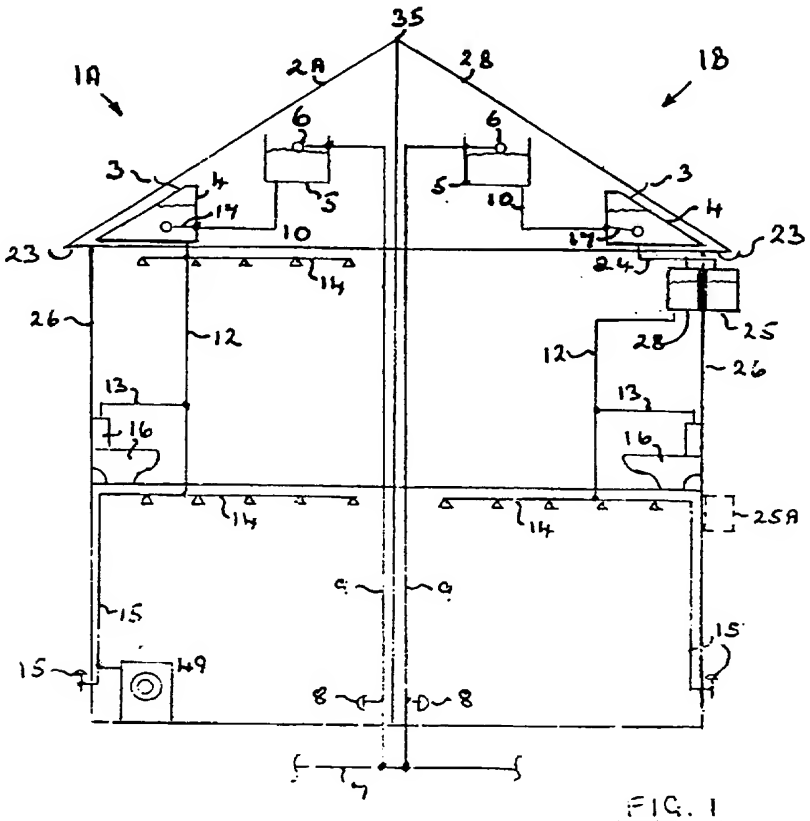
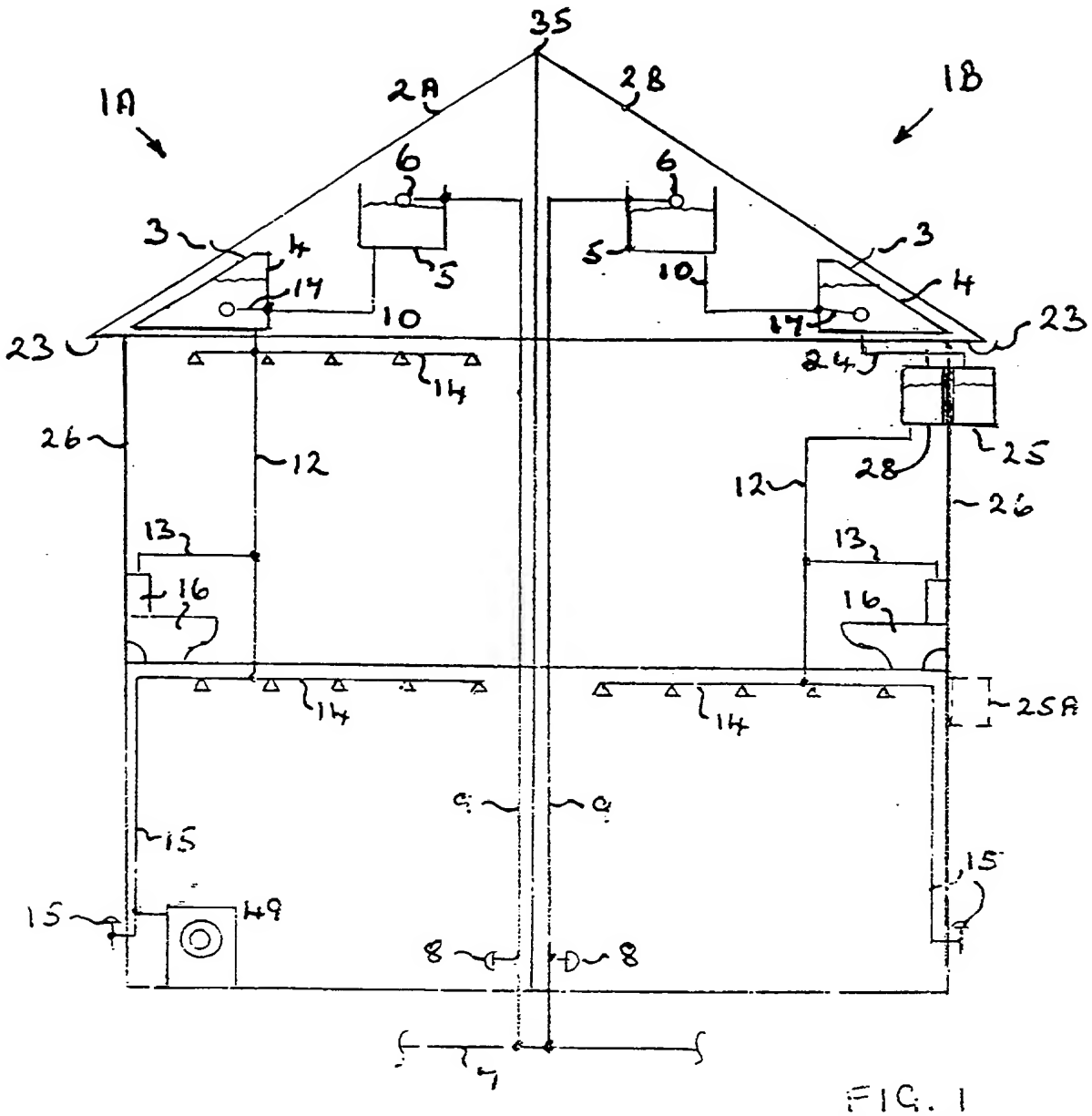


FIG. 1

GB 2 344 132 A


35
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1B
2A
2B
6
6
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4
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5
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14
14
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23
24
25
26
26
12
12
28
13
13
16
16
25A
15
15
15
9
8
8
7

FIG. 1

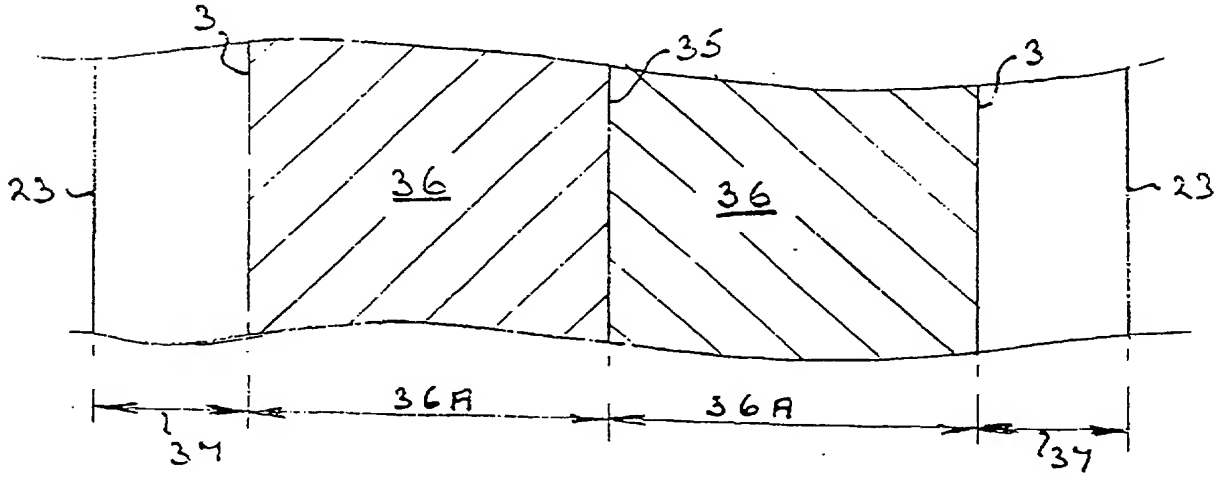

3
35
3
23
23
36
36
36A
36A
34
34

FIG. 2

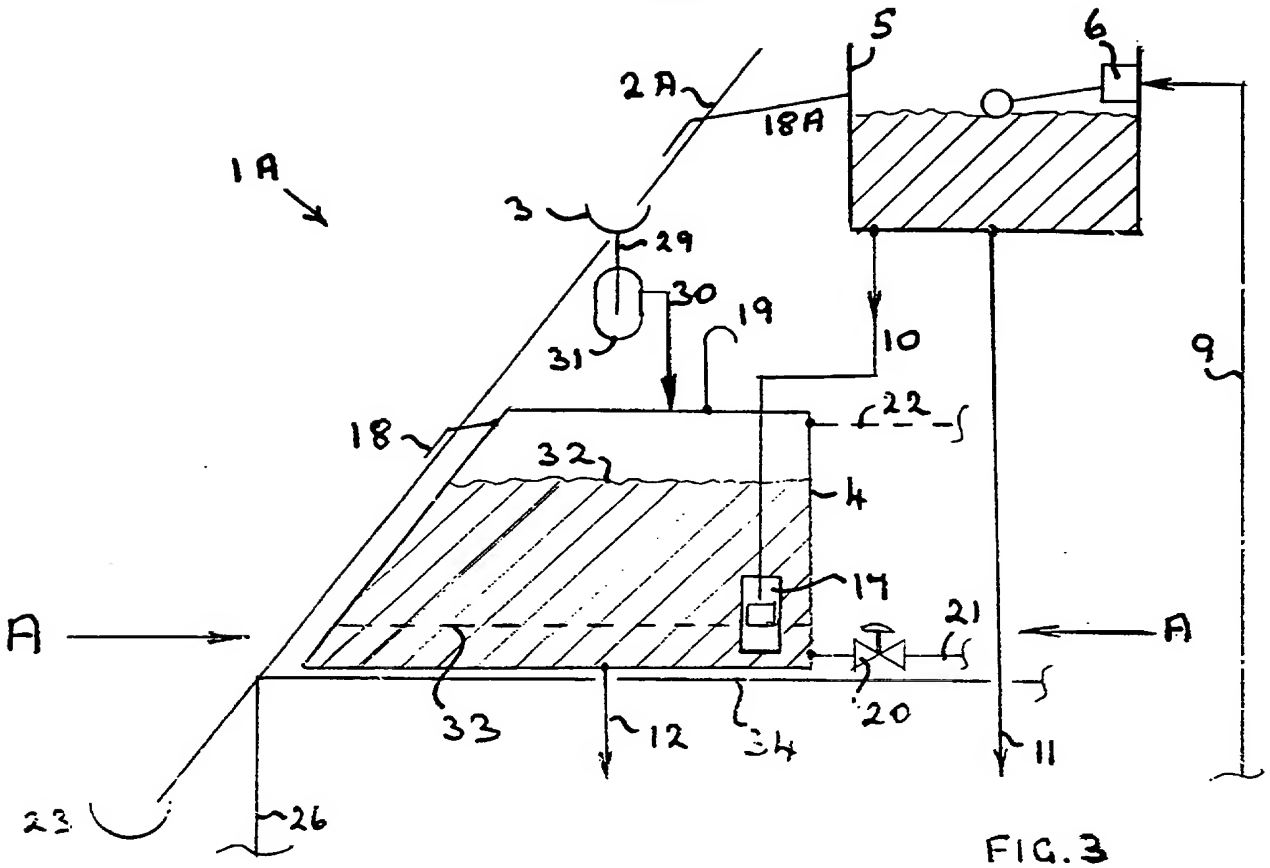

5
6
2A
18A
1A
3
29
30
31
19
10
9
18
22
32
4
17
21
A
A
33
12
34
20
11
23
26

FIG. 3

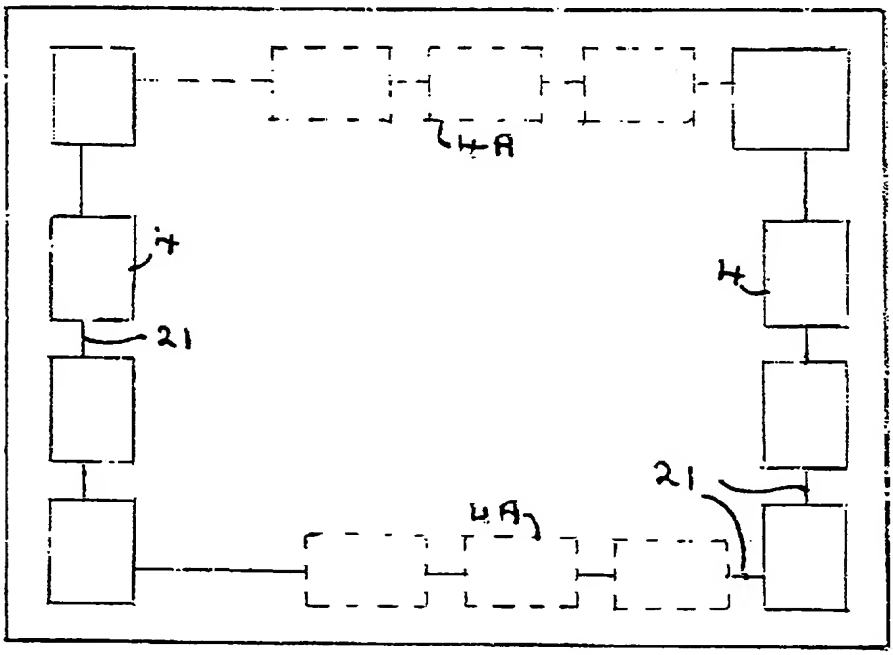

4A
4
4
21
21
4A

FIG. 4

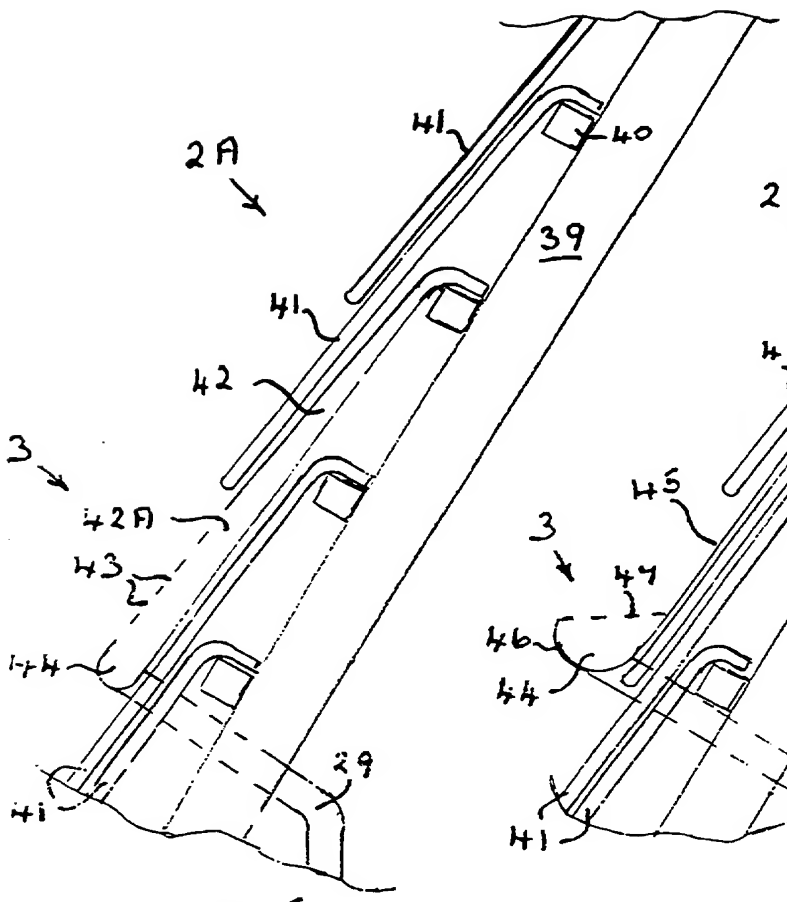


FIG. 5

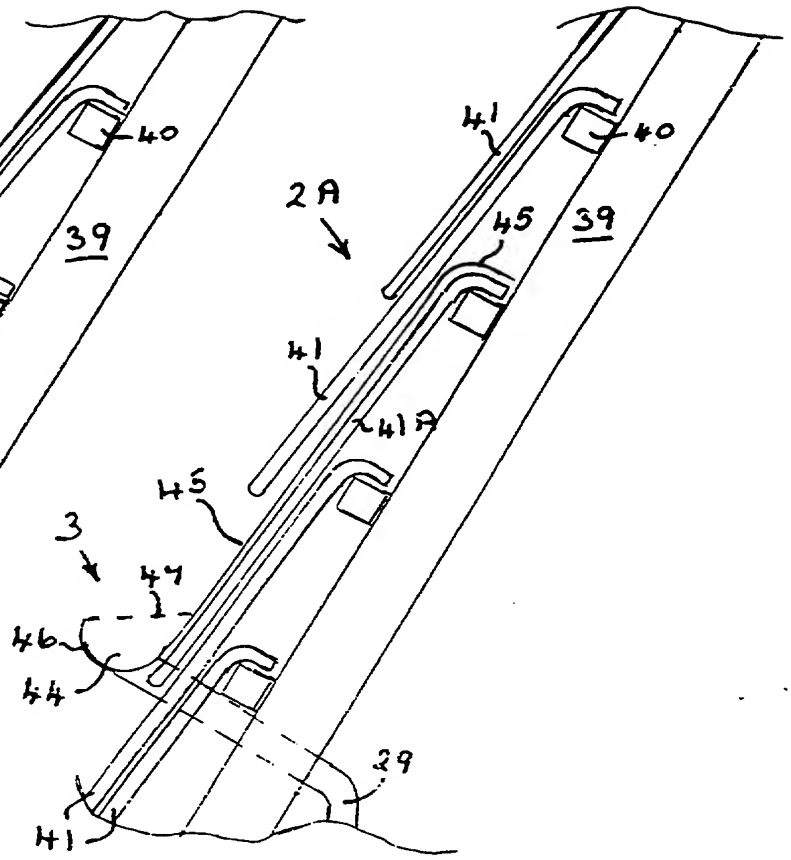


FIG. 6

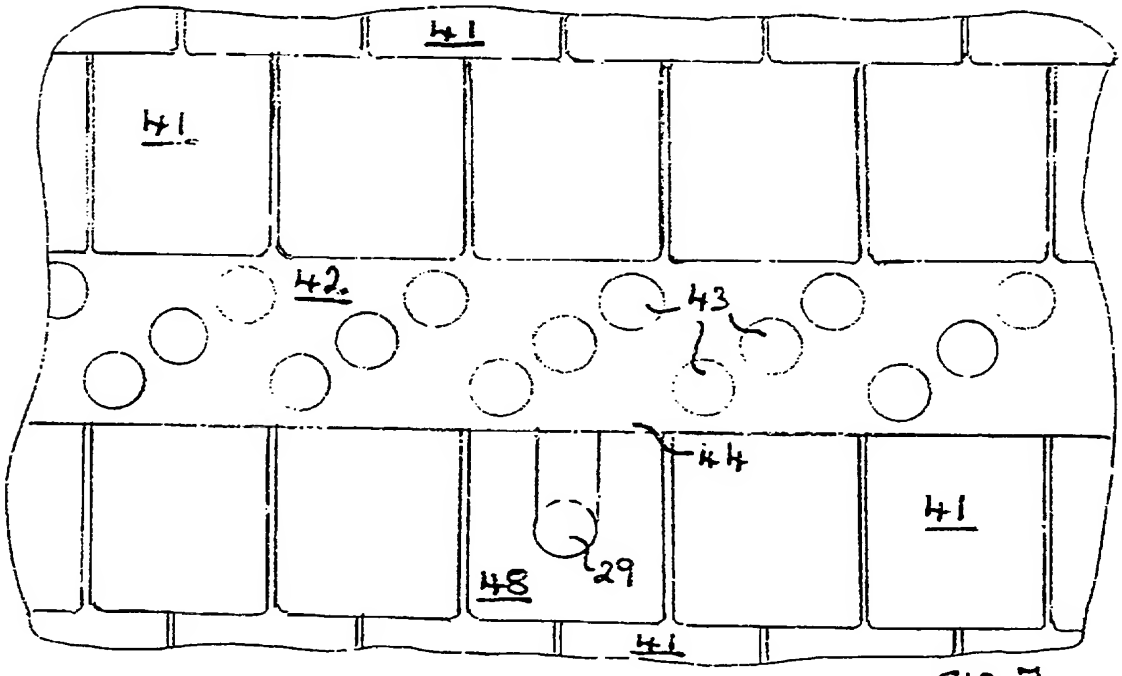


FIG. 7

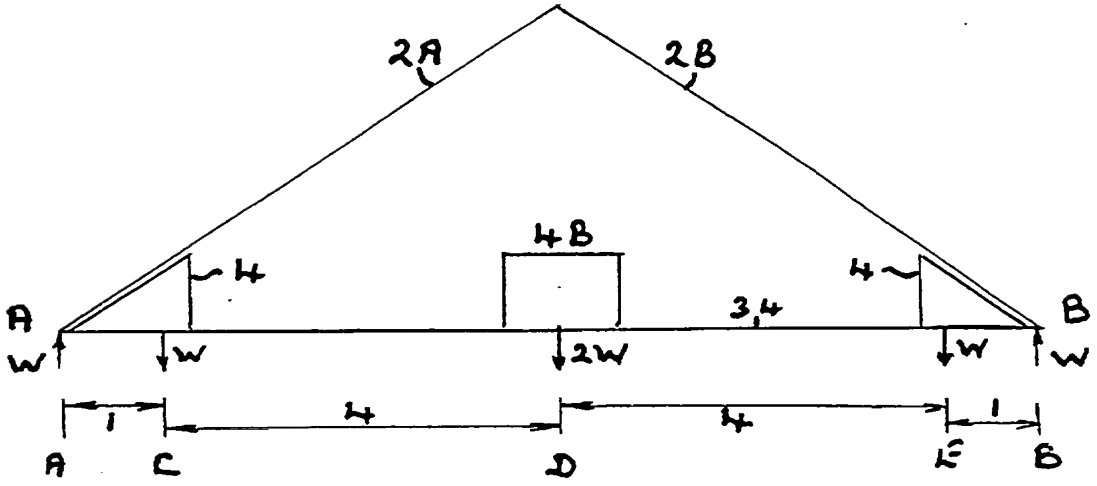
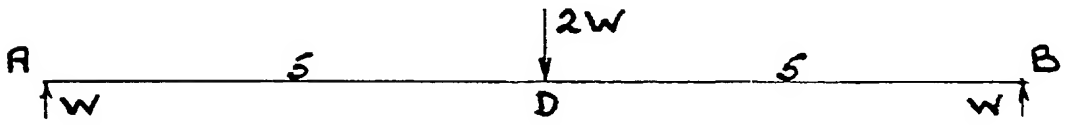


FIG. 8



Taking moments about D (to the right hand side) = -5W

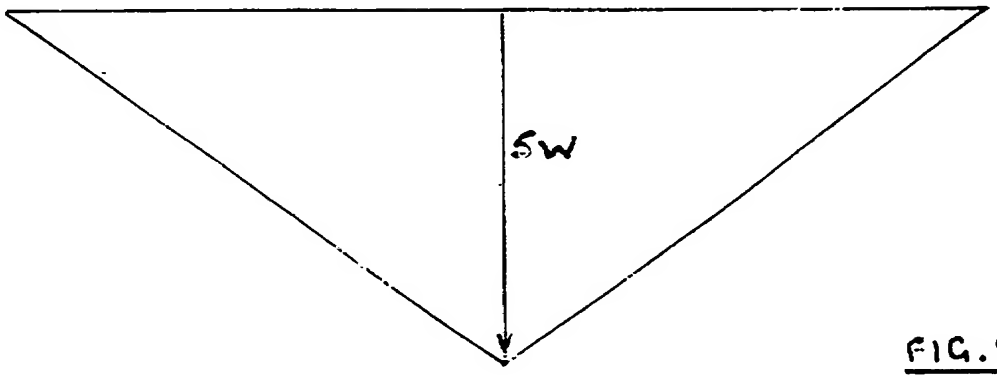
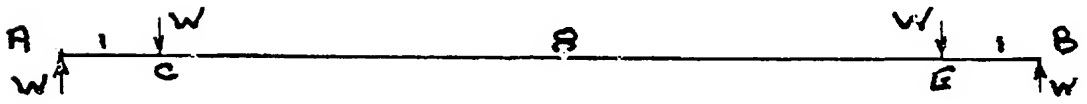


FIG. 9



Taking moments about C (to the right hand side) = 8W - 9W = -W

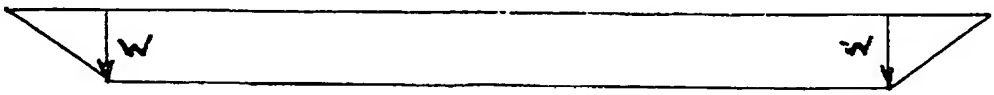


FIG. 10

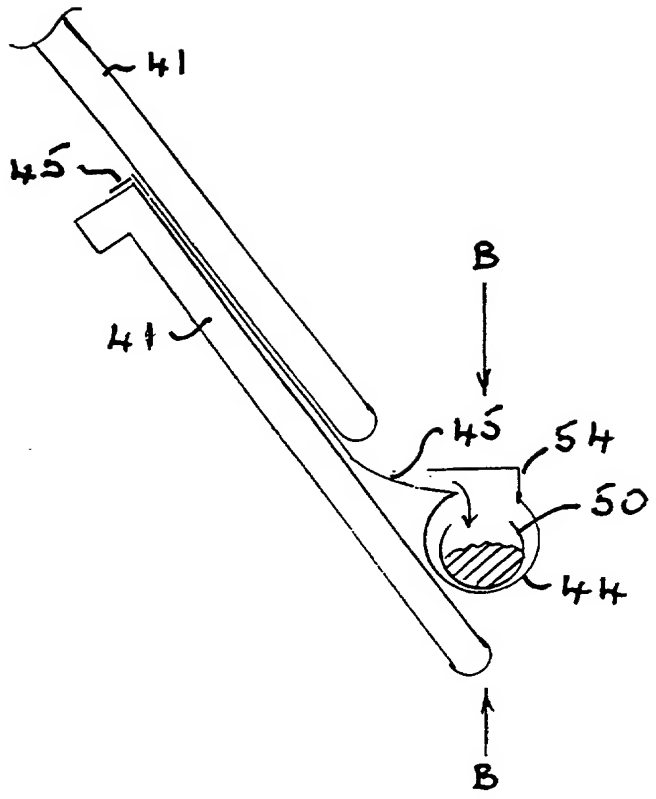


FIG. 11

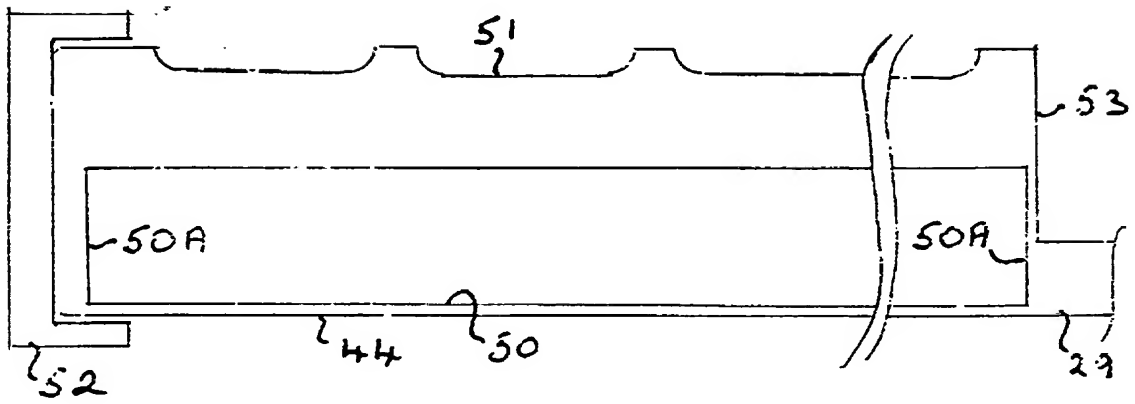


FIG. 12

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IMPROVEMENTS IN/OR RELATING TO THE COLLECTION AND USE OF RAINWATER

This specification relates to the collection and use of rainwater for 'non-hygienic' or 'grey water' domestic purposes, e.g. use in toilets, washing machines, fire sprinkler systems, garden irrigation, etc.

The problem of water shortages during periods of drought are well known and any method to mitigate the effects is important. Means of collecting the rain falling on buildings via the guttering system are known but all involve relatively low level storage tanks from which the water has to be pumped to a higher level if it is to be used in the building on which it has fallen. This, of course, incurs cost. Height is important because a 'head' is required to provide the necessary pressure drop to move water along pipelines, etc., at an acceptable rate for usage. While mains water must be used for 'hygienic' purposes, e.g. drinking, food preparation, personal hygiene (e.g. washing or cleaning teeth), etc., it has become acceptable to use the so called 'grey' water from these processes for 'non-hygienic' applications, e.g. flushing of toilets, in washing machines, watering gardens, etc.

There is thus a need to be able to collect rainwater on a regular basis as and, when available, to be able to use it for non-hygienic purposes. One reason why such systems have not become more popular is the cost associated with pumping water back up to a higher level. This invention provides a purely gravity system which will make use of rainfall as and when it occurs but allows supplementation from the mains during periods of prolonged drought.

Though cost saving is important, it is also sensible to collect and use as much 'free' rainwater as practicable as this has wider environmental benefits, such as:-

- reducing the volume of sewage to be treated (rainwater is passed to the normal sewerage system) and
- saving agricultural or recreational land which might otherwise have to be made into reservoirs to provide water which could otherwise have been saved.

According to the invention there is provided apparatus for the collection and use of rainwater falling onto the roof of a building comprising:-

i) collecting means located on the roof;

ii) storage means located in the eaves of the attic space; and

iii) means to supply the water collected from the storage means for usage;

characterised in that the system uses gravity as the sole means of water transfer and that a mains backup is provided for use during periods of prolonged drought.

According to a first variation of the apparatus of the invention only the higher part(s) of the roof are used for the collection of rainwater.

According to a second variation of the apparatus of the invention, the collecting means is essentially flush with the plane of the roof.

According to a third variation of the apparatus of the invention, the collecting means is wholly or partly proud of the plane of the roof.

According to a fourth variation of the apparatus of the invention, solid impurity collection and removal means are provided.

According to a fifth variation of the apparatus of the invention, the eaves storage tanks are supplemented by additional tanks.

In a preferred design, the storage means are shaped tanks designed to fit inside the attic in the eaves of the roof. Consequently, such tanks would have a basically triangular section to use the space most effectively. The collection means would be placed partway up the slope of the roof at a height which would allow gravity filling of the tanks, preferably via a solid debris collection and removal means. The rainfall collector would preferably extend the whole width of the roof and may discharge into a single storage tank or a number of storage tanks arranged side-by-side along the width of the roof.

In a preferred embodiment, there may be one single tank which accepts the rainwater collected but this tank may be interconnected with others to increase the storage volume. A particular advantage of tanks in the eaves is that a long length of tankage can be provided, thus spreading the load over the attic floor joists. Additional tankage may be provided inside the attic space and / or at higher levels on internal and external walls below the line of the attic floor joists. Where wall-mounted tanks are provided, the water collected in the primary attic storage tank would drain down to the wall tank whence it would be piped into the grey water system. This will still give gravity supply to most applications, e.g. toilets.

In a preferred design, a low level valve is provided in the storage tank, so that, in periods of drought when no rainfall can be collected, mains water is used to fill the lowest portion of the storage tank(s). This option will allow a permanent supply of water to toilet cisterns, etc.

Separate piping would be provided from the storage tank(s) to toilet cisterns, etc. so that the grey water system would be entirely independent of the potable mains water distribution system in the building. Thus, the principle of the invention may be applied to both new construction and as modifications to fit existing installations.

For a clearer understanding of the invention and to show how it may be carried into effect, reference is made, by way of example only, to the accompanying drawings in which:-

Figure 1 is a sectional elevation of a house split into two halves showing two aspects of the invention.

Figure 2 is a projected plan view of the roof area of the house in Fig. 1 showing the area available for water collection.

Figure 3 is a sectional elevation of the eave area of the attic with apparatus according to the invention.

Figure 4 is a plan view of the whole attic, part of which is shown in Fig. 3, along a section through line AA.

Figure 5 is a part section through roof 2A with a collecting means replacing a row of tiles.

Figure 6 is a part section through roof 2A with a collecting means situated over a row of tiles.

Figure 7 is a part plan view of roof 2A showing the location of the collecting means shown in Fig. 5 between adjacent rows of tiles.

Figure 8 is a diagram of a vertical section through the house attic shown in Fig. 1 showing the positions of eaves tanks 4 and a central tank 4B.

Figure 9 is a diagram of the loading of central tank 4B on joists 34, also showing the bending moment diagram.

Figure 10 is a diagram of the loading of eaves tanks 4 on joists 34, also showing the bending moment diagram.

(Figs. 9 and 10 are projections downwards from the attic diagram in Fig. 8.)

Figure 11 is a sectional elevation of a preferred collecting means situated over a row of tiles.

Figure 12 is a sectional elevation through the collecting means in Fig. 11 along section BB showing the means of removal of the solids debris catcher.

In the following description, the same reference numeral is used for the same component, or identical components, fulfilling the same function.

Fig 1 shows a sectional elevation of a house divided vertically down the centre. On the left hand side, 1A, is a diagram of the principle of the apparatus with the storage tank(s) 4 in the eave space of the roof. On the right hand side, 2B, is a variation of the design in which the storage volume is increased by the use of a wall mounted tank(s) 25, 28.

Referring to the left hand side of Fig. 1, collector 3 built into roof 2A directs rainwater falling on the upper part of roof 2A through a pipe into tank 4. From tank 4, a distribution pipe 12 is used to take this rainwater for usage, e.g. toilet 16 via pipe 13, fire sprinklers 14, washing 49 or garden irrigation via pipe and tap 15.

The normal domestic header tank 5 is shown at a level above tank 4. The level in this header tank is maintained by ballcock 6. An additional pipe 10 runs from tank 5 (or mans 9) to a valving means 17 in tank 4. A ballcock 17 is shown in Fig 1 as illustrative of the principle but other types of valves are preferred as will be explained hereinafter. Mains water 7 enters the house via stopcock 8 and pipe 9 to ballcock 6 in tank 5.

Fig 2 shows a projected plan area of roof 2A. Line 23 represents the edge of gutter 23, line 3 represents the edge of roof collector 3 and line 35 represents the apex of the roof. As shown water would be collected only from area 36 of roof 2A. Area 36 is about 60% of the total area of roof 2A.

Fig 3 shows the water storage system in detail. Collector 3, shown diagramatically, takes rainwater from roof 2A via pipe 29 into a debris collector 31. As shown, pipe 29 extends below the surface of the water and allows solid material to collect in the bottom of container 31 where it may be periodically removed. The overflow from debris collector 31 passes via pipe 30 into tank 4. As shown the tank is fairly full with the water level 32. An overflow 18 and air vent 19 are provided. Take off pipe 12 is shown passing through joist line 34. Pipe 11 from header tank 5 takes mains water for hygienic usage.

During periods of drought, no rainwater would be collected 3. Under these conditions water level 32 would fall to a lower level 33. Below this level, the float in valve 17 would drop thus allowing mains water from header tank 5 via pipe 10 into tank 4 to restore the water level 33. The advantage of this system is that only a minimum of mains water is held in tank 4. The volume of water in tank 4 is determined by the position of float valve 17 and water level 33 would be sufficient for supplying toilets and/or fire sprinkler systems, etc. as required.

Fig 4 shows a plan view of the floor of an attic. Inter-connected tanks 4 are shown along both sides and optionally (dashed 4A) along the other two sides of a detached house or fixed to the dividing walls of a terraced property. As shown, all the tanks are inter-connected by pipes 21. A stop valve 20 is shown in pipe 21 in Fig 3, to facilitate

normal plumbing operations. The advantage of this arrangement is that it allows excess rainwater to be collected in a large number of small tanks in the eaves, thus spreading the load widely around the perimeter of the roof, as is explained hereinafter. Small tanks 4 are easier to handle and fit than large ones and may be more suitable for use in existing buildings. A second pipe 22 (Fig. 3), at higher level, is used to connect the ullage air volumes to allow all tanks 4 (and 4A) to fill to the level 32 (or 33) of the main storage tank 4 (Fig. 3). Alternatively, a vent 19 may be provided on each tank 4 (4A).

In periods of normal rainfall, e.g. when rain falls every two or three days, enough water will be collected in tanks 4 to maintain the water between levels 32 and 33 with normal usage so that no mains back up will be required. In these circumstances, the toilet 16 and other systems will be entirely independent of mains supply and thus save a considerable amount of potable water. This will have a significant environmental benefit when widely incorporated into domestic, residential and industrial buildings as it will reduce the supply requirements placed on the water providers. It will also reduce the sewage treatment requirements, as rain water falling in built up areas is channelled via the storm water drains to sewage plants. This, in turn, will reduce the demand for reservoirs allowing land, which might otherwise be converted into a reservoir, to be retained for agricultural or recreational use. Apart from reduced water bills, the building owner, who uses the invention for fire sprinklers, may benefit from a reduced fire insurance premium.

Only after several days without rainfall, when all the water above level 33 has been used, will water be drawn from mains tank 5 via pipe 10 and valve 17. It will thus be apparent that the rainwater and mains supply are two entirely separate plumbing systems distribution systems so that no bacterial cross-contamination can occur. Bacterial growth does not occur in the dark so that this should not affect the grey water system but, if this is perceived to be a problem, appropriate precautions can be taken, e.g. metering of additives into tank(s) 4.

Fig 5 shows one possible design for collector 3. Battens 40 are attached to rafter 39 and tiles 41 placed over, in the conventional method of roof construction. In this example, an elongated hollow tile 42, which may be of metal or non-metallic construction is used

for a complete row of tiles along the width of the roof. The lower part 42A of tile 42 is hollow and has a number of perforations 43 (Fig. 7) on its upper surface. These would be staggered in rows so that every drop of rainwater running down the surface of the roof 2A would be caught. At the lowest edge of tile 42 is a manifold 44 where rainwater would collect and flow to downcommer 29. Downcommer 29 is shown dashed passing through tiles 41. The design of the strip-tile 42 would incorporate downcommer 29, for example, by incorporating the equivalent of a tile 48 (Fig. 7) which would fit in the next tile row 41 down the roof.

This design is preferred for new building when a number of tile strips 42 would be used to form a complete row of tiles across the width of the roof. Each strip would have its own downcommer 29 feeding into one of a number of tanks 4. This design principle allows a range of standard lengths of tile strip 42 to be manufactured. By having individual strips with their own downcommer 29, the Architect can select the appropriate lengths to match the width of the roof and the location of tanks 4 in the eaves space below.

Another variation of the collection principle is shown in Fig 6. This is designed for fitting to existing installations and incorporates a thin member 45 which can be hooked over an existing row of tiles 41A. As shown, the collector consists of a conventional gutter shape 46, covered by a grill 47, to collect leaves, etc., and a manifold 44 to channel the water collected. As with the previous design, downcommer 29 takes the rainwater through the roof to a tank 4. The techniques of replacing a single tile with a means to pass a pipe through the roof are well known to tilers. As before, a variety of standard lengths (with ends, not shown) can be made for fitting to existing rooves. Each would have its own downcommer 29, or be adapted for connection to the next section along the roof.

Fig 7 shows the arrangement of collector tile 42 (Fig. 5) replacing part of a, or a whole, row of tiles 41. Downcommer 29 is incorporated in to a plate 48 which replaces a tile in the next lower row 41.

A preferred design of roof collector is shown in Figs. 11 and 12. Here the manifold 44 has the form of a cylinder with a largely open top formed by scalloped cut outs 51. Manifold 44 is fast with plate 45 which extends upwardly and terminates in a hook to fit over a row of tiles 41. An upstand and shield 54 extends over the opening, allowing rainwater in, as shown by the arrow, but keeping light out. The collector would be made from dark plastic, or metal to avoid the ingress of light which could cause bacterial growth.

Inside manifold 44 is a debris catching trough 50. This is shown as semi-circular in section but could equally well be rectangular. As shown by the arrow (Fig 11), rainwater falls into debris catcher 50, where the solids are retained and the water overflows into manifold 44 and thence via downcommer 29 to tank 4. As trough 50 will remain full of water between showers, light must be excluded to prevent bacterial growth, hence shield 54. The debris catcher 50 is emptied by unscrewing cap 52 and hooking it out by one end 50A. Manifold 44 is closed at both ends, 52, 53 so that all light is excluded and the water is collected 29.

An important advantage of the disclosure is the use of eaves tanks 4 to spread the load over joists 43 and thus avoid the need to reinforce the attic floor to carry the load of large water tanks. Clearly, if rainwater is to be saved, the more that can be collected the better. The use of a large number of small tanks has been taught as one means of spreading the load but the position of the tanks is another factor. It is known to use a single centrally placed tank in attics to store rainwater. Fig. 8 shows a comparison between a single central tank 4B and two eaves tanks 4. The two eaves tanks 4 each carry a weight W of water while tank 4B has a load of 2W. Thus, both the two eaves tanks 4 and central tank 4B have the same total mass of water, 2W, giving the same total load per joist(s) 34. It is the positioning of the 'point' loads that affects the stress in the joists.

Fig. 8 shows that joist 34 is 10 units long and the centres of gravity of eaves tanks 4 are 1 unit in from each wall A and B. Reaction loads of W are shown at A and B to indicate the symmetrical loading of either the two tanks 4, or the single tank 4B. Fig. 9 shows the loading due to tank 4B, and the bending moment (BM) diagram. Taking moments about D, to the right, the reaction at B gives (- 5 x W) = -5W (by convention, anticlockwise turning moments are negative). The BM diagram shows a maximum bending stress of -5W at the mid-point.

Fig. 10 shows the situation with eaves tanks 4. Taking moments about C, the clockwise moment of tank 4 at E is +8W and the reaction at B is -9W giving a net BM of -W. The same situation applies by taking moments to the left at E to give the symmetrical BM diagram shown for both tanks 4. Thus, the two loading cases show that eaves tanks 4 cause only one fifth of the bending stress of the equivalent centrally located mass.

This means that either the size of the eaves tanks can be increased or the rest of the attic space used for other storage to achieve the same joist bending stress as for the central tank 4B. As it is common to use attics for storage, the eaves tank option is clearly preferable. Furthermore, eaves tanks use relatively inaccessible attic space, leaving the more-accessible central part available, e.g. for conversion to additional living space.

Referring to Fig 1, the right-hand side of house 1B shows a variation of the principle disclosed hereinbefore. As previously, collector 3 feeds an eaves tank 4 but here a pipe 24 connects tank 4 to wall mounted tanks 25 and / or 28. Tanks 25 and 28 are mounted as high as practical on either an external (25) or internal (28) wall 26 and their purpose is greatly to increase the storage volume. Feed pipe 12 supplies the grey water system. The position of tanks 25, 28 gives sufficient head to operate upstairs toilets and all downstairs equipment but not for upstairs fire sprinklers.

In cold climates, internal tanks 28 are preferred as there would be no risk of freezing. Winter times are not normally associated with prolonged periods of drought.

Low level valve 17 is shown in tank 4 but could be located in tank 25, or 28 if required. An ullage pipe 22 (Fig. 3) is not shown, but may be included, if required. A lower level tank 25A is also shown, indicating further scope to develop the invention. It will be noted, following the previous teaching about load distribution, that the weight of tanks 25, 25A and 28 is taken directly on wall 26 and not on floors or joists.

As before (Fig. 2), about 60% of the roof area 36 is available for rainwater collection.

The invention disclosed herein builds on the known principles of water collection, storage and usage to provide a practical system which is easily fitted to a new building or, with a minimum of conversion, to an existing building. The collection means gives a minimum of external equipment and visual intrusion and the whole system is operated entirely by gravity. In addition to saving on the cost of metered water, it makes a considerable environmental contribution. Developments of the principle will be obvious to the skilled man, all falling within the scope of the disclosure.

IP36:

What I claim is:-

1. Apparatus for the collection and use of rainwater falling onto the roof of a building comprising:-

i) collecting means located on the roof;

ii) storage means located in the eaves of the attic space; and

iii) means to supply the water collected from the storage means for usage;

characterised in that the system uses gravity as the sole means of water transfer and that a mains backup is provided for use during periods of prolonged drought.

2. Apparatus for the collection and use of rainwater, as claimed in claim 1, wherein only the higher parts of the roof above the level of the storage means are used for water collection.

3. Apparatus for the collection and use of rainwater, as claimed in claim 2, wherein the eaves storage tanks are supplemented by other storage.

4. Apparatus for the collection and use of rainwater, as claimed in claim 3, wherein the other storage is an interconnected attic tank(s).

5. Apparatus for the collection and use of rainwater, as claimed in claim 3, wherein the other storage is a wall-mounted tank(s).

6. Apparatus for the collection and use of rainwater, as claimed in claims 3-5, wherein the storage tanks are shaped to fit the eaves and other inaccessible places.

7. Apparatus for the collection and use of rainwater, as claimed in claim 6, wherein the storage tanks are interconnected so that water can pass between them.

8. Apparatus for the collection and use of rainwater, as claimed in any preceding claim, wherein the storage tank(s) are located so as to minimise the loading on the attic floor supporting joists.

9. Apparatus for the collection and use of rainwater, as claimed in claim 8, wherein a vent to the atmosphere is provided.

10. Apparatus for the collection and use of rainwater, as claimed in claim 9, wherein an overflow is provided.

11. Apparatus for the collection and use of rainwater, as claimed in any preceding claim, wherein the collecting means are essentially flush with the plane of the roof.

12. Apparatus for the collection and use of rainwater, as claimed in claim 11, wherein the collecting means replaces a whole row, or a part of a row, of roof covering elements.

13. Apparatus for the collection and use of rainwater, as claimed in claim 12, wherein the collecting means has perforations for feeding rainwater to a manifold in the collecting means.

14. Apparatus for the collection and use of rainwater, as claimed in claim 13, wherein the collector manifold is connected to a downcommer.

15. Apparatus for the collection and use of rainwater, as claimed in any preceding claim, wherein the collecting means is wholly, or partially, proud of the plane of the roof.

16. Apparatus for the collection and use of rainwater, as claimed in claim 15, wherein the collector means is a gutter arrangement.

17. Apparatus for the collection and use of rainwater, as claimed in claim 16, wherein the gutter arrangement is secured over an existing row of roof covering elements.

18. Apparatus for the collection and use of rainwater, as claimed in claim 17, wherein the gutter arrangement acts as a manifold feeding rainwater into a downcommer.

19. Apparatus for the collection and use of rainwater, as claimed in claims 14-18, wherein means are provided to pass the downcommer through the roof while maintaining a watertight seal.

20. Apparatus for the collection and use of rainwater, as claimed in any preceding claim, wherein solid collection and removal means are provided.

21. Apparatus for the collection and use of rainwater, as claimed in claim 20, wherein the solid collection and removal means is located in / or as a part of the collecting means.

22. Apparatus for the collection and use of rainwater, as claimed in claim 20, wherein the solid collection and removal means is located in the downcommer.

23. Apparatus for the collection and use of rainwater, as claimed in any preceding claim, wherein the means to supply the rainwater is a piping system separate from that which supplies mains water for domestic purposes.

24. Apparatus for the collection and use of rainwater, as claimed in any preceding claim, wherein a valving means is provided in the lower part of a storage tank(s) so that, when the water level in the tank falls below a preset level, said valving means will admit mains water to the storage tank(s) until the water has reached said preset level.

25. Apparatus for the collection and use of rainwater, as claimed in claim 24, wherein the mains water make-up is provided from a mains header tank.

26. Apparatus for the collection and use of rainwater, as claimed in claim 24, wherein the mains water make-up is provided directly from the mains supply.

27. A method for the collection and use of rainwater falling onto the roof of a building comprising the steps of:-

i) providing a collecting means located on the roof of the building;

ii) providing a transfer means from said collecting means to a storage means;

iii) providing a storage means located in the eaves of the attic space at a level below that of said collecting means so that the rainwater collected is transferred, via gravity, from said collecting means to said storage means; and

iv) providing a means to supply the water from said storage means for usage at a lower level in / near the building.

28. A method for the collection and use of rainwater falling onto the roof, as claimed in claim 28, wherein a mains water back-up is provided for use in periods of prolonged drought

29. A method for the collection and use of rainwater falling onto the roof, as claimed in claim 28, wherein solids collection and removal means are provided.

30. Apparatus and method for the collection and use of rainwater as described in and by the above specification with reference to the accompanying drawings.

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What I claim is:-

1. Apparatus for the collection and use of rainwater falling onto the roof of a building comprising:-

i) collecting means located on the roof;

ii) storage means located in the eaves of the attic space; and

iii) means to supply the water collected from the storage means for usage;

characterised in that the system uses gravity as the sole means of water transfer, that the storage means in the eaves spread the load over the joists and minimise bending moments therein and that a mains backup is provided for use during periods of prolonged drought.

2. Apparatus for the collection and use of rainwater, as claimed in claim 1, wherein only the higher parts of the roof above the level of the storage means are used for water collection.

3. Apparatus for the collection and use of rainwater, as claimed in claim 2, wherein the eaves storage tanks are supplemented by other storage.

4. Apparatus for the collection and use of rainwater, as claimed in claim 3, wherein the other storage is an interconnected attic tank(s).

5. Apparatus for the collection and use of rainwater, as claimed in claim 3, wherein the other storage is a wall-mounted tank(s).

6. Apparatus for the collection and use of rainwater, as claimed in claims 3-5, wherein the storage tanks are shaped to fit the eaves and other inaccessible places.

7. Apparatus for the collection and use of rainwater, as claimed in claim 6, wherein the storage tanks are interconnected so that water can pass between them.

8. Apparatus for the collection and use of rainwater, as claimed in claim 7, wherein a vent to the atmosphere is provided.

9. Apparatus for the collection and use of rainwater, as claimed in claim 8, wherein an overflow is provided.

10. Apparatus for the collection and use of rainwater, as claimed in any preceding claim, wherein the collecting means are essentially flush with the plane of the roof.

11. Apparatus for the collection and use of rainwater, as claimed in claim 10, wherein the collecting means replaces a whole row, or a part of a row, of roof covering elements.

12. Apparatus for the collection and use of rainwater, as claimed in claim 11, wherein the collecting means has perforations for feeding rainwater to a manifold in the collecting means.

13. Apparatus for the collection and use of rainwater, as claimed in claim 12, wherein the collector manifold is connected to a downcommer.

14. Apparatus for the collection and use of rainwater, as claimed in any preceding claim, wherein the collecting means is wholly, or partially, proud of the plane of the roof.

15. Apparatus for the collection and use of rainwater, as claimed in claim 14, wherein the collector means is a gutter arrangement.

16. Apparatus for the collection and use of rainwater, as claimed in claim 15, wherein the gutter arrangement is secured over an existing row of roof covering elements.

17. Apparatus for the collection and use of rainwater, as claimed in claim 16, wherein the gutter arrangement acts as a manifold feeding rainwater into a downcommer.

18. Apparatus for the collection and use of rainwater, as claimed in claims 13-17, wherein means are provided to pass the downcommer through the roof while maintaining a watertight seal.

19. Apparatus for the collection and use of rainwater, as claimed in any preceding claim, wherein solid collection and removal means are provided.

20. Apparatus for the collection and use of rainwater, as claimed in claim 19, wherein the solid collection and removal means is located in / or as a part of the collecting means.

21. Apparatus for the collection and use of rainwater, as claimed in claim 19, wherein the solid collection and removal means is located in the downcommer.

22. Apparatus for the collection and use of rainwater, as claimed in any preceding claim, wherein the means to supply the rainwater is a piping system separate from that which supplies mains water for domestic purposes.

23. Apparatus for the collection and use of rainwater, as claimed in any preceding claim, wherein a valving means is provided in the lower part of a storage tank(s) so that, when the water level in the tank falls below a preset level, said valving means will admit mains water to the storage tank(s) until the water has reached said preset level.

24. Apparatus for the collection and use of rainwater, as claimed in claim 23, wherein the mains water make up is provided from a mains header tank.

25. Apparatus for the collection and use of rainwater, as claimed in claim 23, wherein the mains water make-up is provided directly from the mains supply.

26. A method for the collection and use of rainwater falling onto the roof of a building comprising the steps of:-

i) providing a collecting means located on the roof of the building;

ii) providing a transfer means from said collecting means to a storage means;

iii) providing a storage means located in the eaves of the attic space so that the load is spread over the joists and bending moments therein minimised and at a level below that of said collecting means so that the rainwater collected is transferred, via gravity, from said collecting means to said storage means; and

iv) providing a means to supply the water from said storage means for usage at a lower level in / near the building.

27. A method for the collection and use of rainwater falling onto the roof, as claimed in claim 26, wherein a mains water back-up is provided for use in periods of prolonged drought.

28. A method for the collection and use of rainwater falling onto the roof, as claimed in claim 27, wherein solids collection and removal means are provided.

29. Apparatus and method for the collection and use of rainwater as described in and by the above specification with reference to the accompanying drawings.

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Application No: GB 9919798.0 **Examiner:** D. Haworth
Claims searched: 1-30 **Date of search:** 11 November 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): E1X (XK1)

Int Cl (Ed.6): E03B 3/02

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X,P	GB 2328471 A	(Sanderson)	1-30
X	GB 2312013 A	(Pearce) - see especially Fig. 8	1-30
X	GB 2286849 A	(Langford)	1-30
X	GB 2220223 A	(Long)	1-30
Y	GB 2291924 A	(Myland)	11 and 12
Y	GB 2228521 A	(Mottley)	11 and 12
Y	GB 0293224 A	(Adams)	11 and 12

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

PUB-NO: GB002344132A
DOCUMENT-IDENTIFIER: GB 2344132 A

TITLE: Rainwater collection and supply

PUBN-DATE: May 31, 2000

INVENTOR-INFORMATION:

NAME	COUNTRY
NICHOLAS, BRIAN LESLIE	GB

ASSIGNEE-INFORMATION:

NAME	COUNTRY
NICHOLAS BRIAN LESLIE	GB

APPL-NO: GB09919798
APPL-DATE: August 23, 1999

PRIORITY-DATA: GB09825798A (November 25, 1998)

INT-CL (IPC): E03B003/02

EUR-CL (EPC): E03B001/04